



Review

Injuries from intimate partner and sexual violence: Significance and classification systems

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ABSTRACT

While intimate partner violence (IPV) and sexual violence (SV) are highly associated with injury, the healthcare and legal significance of these injuries is controversial. Purpose: Herein we propose to explore the significance of injury in IPV and SV and examine the current status of injury classification systems from the perspectives of the healthcare and criminal justice systems. We will review current injury classification systems and suggest a typology of injury that could be tested empirically.

Findings: Within the published literature, we found that no commonly accepted injury typology exists. While nuanced and controversial issues surround the role of injury detection in the sexual assault forensic examination, enough evidence exists to support the continued pursuance of a scientific approach to injury classification. We propose an injury typology that is measurable, is applicable to the healthcare setting and criminal justice system, and allows us to use a matrix approach that includes a severity score, anatomic location, and injury type. We suggest a typology that might be used for further empirical testing on the validity and reliability of IPV and SV injury data.

Conclusion: We recommend that the community of scientists concerned about IPV and SV develop a more rigorous injury classification system that will improve the quality of forensic evidence proffered and decisions made throughout the criminal justice process.

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1. Introduction

Intimate partner violence (IPV) and sexual violence (SV) frequently lead to physical injury (see definitions in [Table 1](#)). The healthcare and criminal justice significance of these injuries, however, is controversial, and no widely accepted classification system exists for genital and non-genital injury related to IPV and SV. The issues surrounding the significance of injury in victims who survive their injuries present a complex and nuanced situation. In 2001, Lincoln noted that little is known about the implications of

injury findings.¹ She suggested that in order for the medicolegal significance of genital injury to be interpreted accurately, scientists need to strengthen the empirical data that we use to understand injury in the context of consensual and non-consensual sexual intercourse. Sommers et al. agreed with Lincoln. They observed that injury findings can be used to corroborate other physical evidence and testimony, influence more objective decision making in the criminal justice system, and ultimately contribute to the quality of justice for victims of SV and IPV.² These authors did not suggest that a woman must be injured to “prove” rape. Rather, they explained that injury or lack of injury is part of the constellation of evidence collected in the forensic examination and used by the criminal justice systems.^{1,2}

In contrast, White and Dumont suggested that the demand for visual proof of SV, such as injury, reinforces a positivist approach

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that decontextualizes a victim's history and physical examination.³ They observed that, when examiners make precise measurements of injuries, they diminished the victim's experience as it becomes represented by empirical, technological facts rather than the victim's narrative. With respect to genital and non-genital injury in the context of IPV and SV, such controversies bear careful consideration.

The lack of consistency in the classification systems used to describe genital and non-genital injury complicates the significance of injury. While Slaughter et al. developed a system that is based on injury type (T (tears), E (ecchymosis), A (abrasions), R (redness) and S (swelling), or TEARS),⁴ widespread acceptance of this typology has not occurred (see Tables 2 and 3). First, it is more appropriate to genital injury as compared to non-genital injury, which has a broader range of presentations such as fractures and ligation

injury. Second, questions have been raised as to the discriminating ability of several components of the TEARS system, particularly swelling and redness. Either redness or swelling is not included in some classification systems or data analyses,^{2,5,6} or redness and swelling are viewed as low-level, minor types of injury.^{7,8} Third, debate exists about the appropriateness of the terms: Should “ecchymosis” and bruising be used interchangeably⁹ and are “tears” and lacerations the same phenomenon?⁴ (see Table 1)

The purpose of this article is to: (1) explore the significance of injury in IPV and SV and; (2) examine the current status of injury classification systems. We will analyze the arguments surrounding the significance of injury in the healthcare and legal context by considering the healthcare, forensic, and criminal justice literature. We will review current injury classification systems, and recommend the next steps necessary to understand the role of injury in

Table 1
Definitions.

Uniform definitions related to IPV and SV	Definition and citation	
Intimate partner violence	Physical, sexual, or psychological harm by a current or former partner or spouse. It IPV can occur among heterosexual or same-sex couples and does not require sexual intimacy. ¹²	
Physical violence	The intentional use of physical force with the potential for causing death, disability, injury, or harm. Physical violence includes, but is not limited to: scratching, pushing, shoving, throwing, grabbing, biting, choking, shaking, poking, hairpulling, slapping, punching, hitting, burning, use of a weapon (gun, knife, or other object), and use of restraints or one's body, size, or strength against another person. Physical violence also includes coercing other people to commit any of the above acts. ¹²	
Physical injury	Any physical damage occurring to the body resulting from exposure to thermal, mechanical, electrical, or chemical energy interacting with the body in amounts or rates that exceed the threshold of physiological tolerance, or from the absence of such essentials as oxygen or heat. ¹²	
	Genital injury- physical damage to the external genitalia (labia majora, labia minora, periurethral area, perineum, posterior fourchette, and fossa navicularis); internal genitalia (hymen, vagina, cervix); and anus (anus, rectum). ²	
	Non-genital injury- physical damage to the body outside the external, internal, and anal areas.	
Rape	Forced sexual intercourse including both psychological coercion as well as physical force. Forced sexual intercourse means vaginal, anal or oral penetration by the offender(s). This category also includes incidents where the penetration is from a foreign object such as a bottle. Includes attempted rapes, male as well as female victims and both heterosexual and homosexual rape. Attempted rape includes verbal threats of rape (U.S. Department of Justice, 2010). ⁷⁵	
Sexual assault	A wide range of victimizations, separate from rape or attempted rape. These crimes include attacks or attempted attacks generally involving unwanted sexual contact between victim and offender. Sexual assaults may or may not involve force and include such things as grabbing or fondling. Sexual assault also includes verbal threats (U.S. Department of Justice, 2010). ⁷⁵	
Sexual violence	Use of physical force to compel a person to engage in a sexual act against his or her will, whether or not the act is completed; an attempted or completed sex act involving a person who is unable to understand the nature or condition of the act, to decline participation, or to communicate unwillingness to engage in the sexual act (e.g., because of illness, disability, or the influence of alcohol or other drugs, or due to intimidation or pressure); abusive sexual contact. ¹²	
Injury definitions	Definition	Subcategory definitions
Tear (some practitioners prefer that the word “laceration” replace tear)	Any breaks in tissue integrity including fissures, cracks, lacerations, cuts, gashes or rips.	<i>Cut</i> : wound made by a sharp instrument or object, but may also be caused by splitting of the skin from blunt trauma. Cuts are deeper rather than wider and tend to be in a line. <i>Fissure</i> : break in the skin, usually where it joins the mucous membrane, producing a crack-like wound. <i>Gash</i> : wound made by cutting; slash. <i>Incision</i> : purposeful cut made by a sharp instrument. <i>Laceration</i> : injury caused by tearing or splitting of the skin from a blunt object; has irregular margins and often a free outer opening; tends to be wider rather than longer; tends to not be in a line; often over a bony surface. <i>Rip</i> : tear or split in the skin.
Ecchymosis (some practitioners prefer that the word “bruising” replace ecchymosis)	Skin or mucous membrane discolorations, known as “bruising” or “black and blue” areas; due to the damage of small blood vessels beneath the skin or mucous membrane surface.	For practical purposes bruising and ecchymosis are defined similarly, but technically they are different. <i>Bruise (contusion)</i> : bleeding underneath the tissue due to blunt force; discoloration due to hemorrhage into tissue from ruptured blood vessels from beneath the skin surface without the skin itself being broken; color is red–blue–purple–yellow–green. As blood is absorbed, the skin discoloration changes from red/blue to yellow and green <i>Ecchymosis</i> : skin discoloration caused by the escape of blood into the tissues from ruptured blood vessels; bleeding into the skin or purpura due to anticoagulants, aspirin, or other product or other products. Many experts also include trauma as a cause of ecchymosis.
Abrasion	Skin excoriations caused by the removal of the epidermal layer and with a defined edge.	<i>Abrasion</i> : superficial wound caused by rubbing or scraping the skin or mucous membrane. <i>Avulsion</i> : tearing away a structure or part of a structure; removal of all of the layers of skin in an abrasion.
Redness	Erythemous skin that is abnormally inflamed due to irritation or injury without a defined edge or border.	<i>Erythema</i> : redness of the skin due to capillary congestion from irritation, injury, infection, allergy, or radiation.
Swelling	Edematous tissues; transient engorgement of traumatized tissues due to fluid accumulation.	<i>Edema</i> : fluid accumulation in the interstitial space.

Table 1 (continued)

Other definitions: in documentation of sexual assault that goes to court, these injuries would be described (appearance, size, shape) but there would be no attribution as to causation by the examiner. These descriptions are simply to provide information on the nature and scope of possible injuries.

Chop wounds: deep gaping wounds, often involving major structures, that result from the use of relatively heavy and sharp objects such as meat cleavers, axes, machetes, and brush hooks. If the instrument is fairly sharp, wounds may show a mixture of both sharp and blunt characteristics. Key to recognizing them is the combination of force and depth.

Defensive injuries (defense wounds, parrying wounds): injuries incurred in attempts to ward off blows of a weapon or assailant or while trying to grasp a sharp weapon. Injuries often occur on the forearm(s) or hand(s).

Petechiae: small (<3 mm), pin-point, non-raised, round areas that are purple or red; caused by blood leaking from capillaries as a result of tissue injury or disorders leading to minor intradermal or submucosal hemorrhage such as thrombocytopenia.

Purpura: purple patches that are greater than 3 mm in size and that occur in the skin, organs, and mucous membranes (including the lining of the mouth). Caused by bleeding in the skin layers due to injury or illness.

Puncture: wound that occurs because of piercing of the skin with a pointed object or instrument; wound is circular.

Skin injury may take on the form of the object inflicting the trauma.

- *Belt injury:* tissue trauma with linear, red, areas and imprint of corners; often thickened discolorations that are raised and sometimes with repeating pattern on it from the pattern on belt.
- *Cigarette burn:* circular wound or discoloration, 0.5 cm, round, with scab or crusting and red perimeter or frame; redness, blisters, and/or oozing occurs depending on degree of burn.
- *Fingertip injury:* bruises or redness from pressure or choking (strangulation); marks are oval/circular or bluish; often four circular bruises about half centimeter round on the right and left sides of neck; thumb print injury looks wider than fingertip injury.
- *Ligature:* soft tissue swelling, redness, abrasions, lacerations, or contusions at the neck (or the area that the ligature was used) and sometimes accompanied by fracture of the upper or lower thyroid horns; conjunctival petechiae; hoarseness.
- *Shoe print:* mark that occurs from being kicked or stepped on; usually oblong, irregular, circular, with red and blue bruising, and sometimes with a repeating pattern.
- *Twisting injury:* mark with red/blue coloration; pattern is more linear. Sometimes area is wide because of holding and letting go; tender to touch.
- *Bite injury:* wound is round or oval shaped with an uninjured portion in the center; wounds are red and tender and sometimes with breaks in skin.
- *Fist injury:* bruise or set of oval or circular bruises; represents knuckle marks with redness, tenderness, and swelling.

Table 2
Classification systems used by investigators studying genital and non-genital injury prevalence following consensual sexual intercourse and sexual assault, 1990–2010

Authors	Country of sample	Classification of injury	Sample	Findings
Adams et al. ⁷	USA	0: None; 1: redness or swelling; 2: bruising or abrasion; 3: tears subset of injured victims 0: None; 1: redness and/or swelling; 2: bruising; 3: abrasion and/or tear	Females 14–19 years of age (<i>n</i> = 214) who were sexually assaulted; 55% White, 9% African American, 8% Mexican American	36% of victims had no signs of injury; 25% injured at one site; 21% injured at 2 sites; 11% 3 sites; 5% injured at 4 or 5 sites
Ahnamugan and Asuen ⁷⁶	Nigeria	Lacerations Tears	Females 15–51 years of age following consensual sexual intercourse (<i>n</i> = 15)	Ten females had single tears; five had multiple tears/lacerations
Anderson et al. ^{50,51}	USA	TEARS Pain	Healthy females 18–40 years of age within 48 h after consensual sexual intercourse (<i>n</i> = 40); 31 White; African American 3; Asian 1; Pacific Islander 1; Hispanic 3; Other 1	No report of injury prevalence. Significant decrease in injury surface area and redness over time as injuries healed in the first 72 h after sexual intercourse.
Anderson et al. ⁵²	USA	TEARS	Health females following consensual sexual intercourse (<i>n</i> = 46; ages 21–45 years of age) and females after sexual assault (<i>n</i> = 56; ages 16–54 years of age); 19 Black; 73 Caucasian; 6 Hispanic; 3 Asian; 1 unknown	30.4% of consensual participants (<i>n</i> = 30) and 32.1% of non-consensual participants (<i>n</i> = 56) had injury present (n.s.)
Baker and Sommers ³⁰	USA	TEARS	Females 14–29 years of age (<i>n</i> = 234) who were sexually assaulted; African American 50%; White 49%; Other 1%	When considered as a group, adolescents were not more likely to sustain an injury than adults; mean number of genital injuries was 1.81
Baker et al. ⁵³	USA	TEARS	Females 14–29 years of age (<i>n</i> = 234) who were sexually assaulted; African American 50%; White 49%; Other 1%	Overall injury prevalence was 62.8%. Race was significantly associated with frequency of injuries in several anatomical locations, with White/Caucasian participants having a higher frequency of injuries than Black/African American participants.
Beh ⁷²	China	Bodily injury: bleeding genital injury; vulval injury; recent hymenal injury	Females 4–66 years of age (<i>n</i> = 350) who were sexually assaulted; 169 were sexually active; no race/ethnicity identified	Bleeding genital injury 12% Vulval injury 8% Recent hymenal injury 10% 35% Showed signs of bodily injuries (likely defined as genital injury)

Table 2 (continued)

Authors	Country of sample	Classification of injury	Sample	Findings
Biggs et al. ⁷³	Canada	Non-perforating soft tissue injuries (bruises, bites, redness, swelling) Lacerations (tears, cuts, abrasions) Current bleeding (history or evident on exams; healed hymenal perforations) Locations: labia majora and minora, posterior fourchette and introitus, hymen, vagina, cervix, anus	Females 15–64 years of age ($n = 132$); no race/ethnicity identified	Overall genital injury 45% with 65% in those with no previous sexual intercourse history and 26% in those previously sexually active
Bowyer and Dalton ⁴⁰	Great Britain	Tears: perineal, hymeneal, posterior vaginal well	Females 16–48 years of age who were sexually assaulted ($n = 83$); no race/ethnicity identified	22 of 83 women had genital injuries; 68 of 83 had some form of physical injury but most injuries were minor
Drocton et al. ⁴⁵	USA	Scratches, bruises, and grazes Injury and no injury	Females 12 years of age and older who were sexually assaulted ($n = 3,356$); 39.6% White; 37.7% Hispanic; 16.6% African American; 8% Asian and other	49% sustained ano-genital injury; increased risk for injury occurred with penetration or attempted penetration using penis, finger, or object
Everett and Jimerson ⁷⁴	USA	Genital: Minor lacerations or abrasions; major lacerations Non-genital: abrasions and contusions; choke-related; lacerations; stab wounds; gunshot wounds	Females 2–71 years of age who were sexually assaulted ($n = 117$); 70% White; 73% Black; 7% Indian	15 of 117 patients sustained serious physical injury and 60 of 117 sustained minor injury; 19% sustained minor genital lacerations or abrasions; 7% sustained major genital lacerations; 38% had minor non-genital abrasions or contusions, 2% had strangulation injury; 2% had non-genital lacerations
Fraser et al. ⁵⁴	Australia Dominican Republic Finland USA	Genital: Micro-ulcer, abrasion, petechial hemorrhage, sub-epithelial hemorrhage and swelling, erythema, edema, epithelial tear	Healthy sexually active females 18–35 years of age undergoing a gynecologic examination ($n = 107$); no race/ethnicity identified	In 107 sexually active women with a total of 314 inspections, 56 injuries were found, most commonly petechiae ($n = 13$) and redness ($n = 4$)
Goodyear-Smith ⁵⁵	New Zealand	Injury: any type of bruising, inflammation, tenderness, abrasions, lacerations, or fractures Location: genital, anal, body (face, head, trunk, arms, legs)	Victims (91% female) 2–83 years of age ($n = 190$) following sexual assault; 76% European; 8% Maori; 11% Pacific Islander; 4% other	19.5% of children and 40.5% of adults sustained genital injury; 9.0% of children and 64% of adults sustained body injury
Grossin et al. ⁵⁶	France	Genital lesions: tears, abrasions General body trauma: bruises, scratches, abrasions, cuts, bites	Victims (86% female) 1.5–79 years of age ($n = 418$) following sexual assault; no race/ethnicity identified	General body trauma was found in 39.1% examined within 72 h of sexual assault and 6.3% examined after 72 h; genital trauma was found in 35.7% examined within 72 h of sexual assault and 19.5% examined after 72 h
Helweg-Larsen ⁷⁰	Denmark	No injuries Minor injuries Severe injuries	Victims of sexual assault 14–67 years of age ($n = 74$); no race/ethnicity identified	Immediate reaction of the legal system to the offense (filing of charges) was related to injury but there was no relationship between the grade of the injury and the severity of the penalty
Hilden et al. ³⁸	Denmark	Genital: tears, ecchymoses, abrasions Non-genital injury: slight, moderate, severe	Females 12–50 years of age ($n = 249$) following sexual assault; no race/ethnicity identified	32% sustained genital injury; no association found between genital and non-genital injury
Hillman et al. ⁵⁷	Great Britain	Skin and mucosal damage	Males 16–43 years of age ($n = 28$) following sexual assault; no race/ethnicity identified	57% reported skin or mucosal damage
Jones et al. ³¹	USA	TEARS	1917 records from sexual assault victims; 84% 18–49 years; 4% ≥ 50 years 74% of younger group and 79% of older group were White	Post-menopausal victims had a greater mean number of non-genital (2.3 versus 1.2, $p < 0.001$) and genital injuries (2.5 versus 1.8, $p < 0.001$)
Jones et al. ³⁶	USA	Abrasion Ecchymosis Edema Erythema Tears/laceration	766 records of female sexual assault victims; 42% 13–17 years; 53% ≥ 18 years; 75% of younger group and 74% of older group were White	Adolescents (13–17 years of age) were more likely to be injured than older (>17 –82) females (83% versus 64%)

(continued on next page)

Table 2 (continued)

Authors	Country of sample	Classification of injury	Sample	Findings
Jones and Worthington ⁵⁸	USA	Grade I: isolated genital laceration below hymen Grade II: isolated genital laceration including hymen Grade III: isolated genital laceration including vagina Grade IV: grades II or III injury plus partial tear of anorectum Grade V: grade III injury plus complete tear of anorectum	44 Girls under 21 years of age with genital injuries requiring surgical repair; 11 had been sexually assaulted	Injuries of 9 of 11 of sexually assaulted girls (82%) involved hymen, vagina, anus, or rectum and had average severity scores of 2.1
Lenahan et al. ⁵⁹	USA	Ecchymosis Abrasions Lacerations	Females 15 years if age or older ($n = 17$) following sexual assault;	53% had genital trauma; 76% had evidence of extra-genital trauma
Light et al. ⁶⁰	USA	Physical injury or no physical injury	Males 18 years of age and older from the Violence and Threats of Violence Against Women and Men in the United States Survey ($n = 219$) following sexual assault; 80% White; 10% African American/Black, 10% other	11% reported physical injury
Maguire et al. ⁵	Ireland	Bruises Abrasions Lacerations Burns Stab wounds Redness and swelling were excluded	Sexual assault victims ages 13–74 ($n = 164$); no race/ethnicity identified; two victims refused examination	Injury was detected in 80%; 99 of 162 had body injury and 60 of 162 had genital injury
Manser ⁶¹	Great Britain	Injured or not injured Anal abrasion, laceration, bruising, redness, scarring, edema	Sexual assault victims ($n = 153$); no race/ethnicity identified	74% sustained injuries
McCauley et al. ⁶²	USA	Lacerations visualized with and without toluidine-blue contrast	Females ages of 19 and older ($n = 24$) following sexual assault; 20 African American/Black; 4 White	Detection of injury increased from 1 in 24 to 14 in 24 with toluidine-blue application; hypervascularity as a was considered a non-injury finding
Olusanya et al. ⁶³	Nigeria	Bruising Laceration Tear Contusion	Sexual assault victims ages 2–33 years of age ($n = 330$); no race/ethnicity identified	44.7% of the children and 16.4% of the adults had genital injury; 9.4% of the children and 22.8% of the adults had non-genital injury
Palmer et al. ⁶	Australia	Non-genital (bruises, abrasions, lacerations, and fractures) classified as minor; moderate; severe Genital (abrasions, bruises, lacerations, other) classified as minor, moderate; severe	Sexual assault victims 14–73 years of age ($n = 153$); no race/ethnicity identified	Genital injuries occurred in 22%; non-genital injuries occurred in 46%; women 40+ had 3.1 times the odds of non-genital injury and 5.6 times the odds of genital injury compared to those 14–19 years of age
Ramin et al. ⁴⁷	USA	Genital trauma: abrasions/edema, hematomas, lacerations Extra-genital trauma: hematoma/ecchymosis, scratches, lacerations	Cases from a sexual assault registry included 129 females 50 years of age and older and were compared to 129 females 14–49 years of age; older group was 32% African American/Black, 64% White, 4% other; younger group was 53% African American/Black, 38% White, 9% other	In post-menopausal women, 32% had abrasions, 3% hematoma, and 19% lacerations; in the under-50 females, 16% had abrasions, 2% hematomas, and 5% lacerations
Riggs et al. ³⁷	USA	General body trauma: Lacerations, abrasions, contusions Genital trauma (no classification)	Female and male ($n = 41$) sexual assault victims ($n = 1076$) ages 1–85 years of age; 26.1% were younger than 18 years of age; no race/ethnicity identified	Overall general body trauma was 67% (extremities were most common followed by head and neck); genital trauma was 53%; 20% had no trauma
Sachs and Chu ³³	USA	Abrasions Tears Ecchymosis Redness and swelling were excluded	Females less than 15 years of age to 40 and older ($n = 209$); Injured: 67 African American, 55 other, 46 White; No injury: 11 African American, 14 other, 15 White	169 with injury, 40 without injury; white women were more likely to sustain injuries than African American women; an increased likelihood for females less than 15 years of age to have injury
Sau et al. ⁶⁴	India	Vaginal bleeding Introital injury Lower vaginal injury	Admission to hospital for non-obstetric injuries ($n = 31$); no race/ethnicity identified	Injury to vaginal vault most common consensual injuries; despite need for blood transfusions and surgery for some women, authors did not attribute any injury to sexual assault
Sill ⁶⁵	Papau New Guinea	Laceration Hematoma Tear	Females ($n = 25$) admitted to hospital for non-obstetric injuries	Females ($n = 13$) following consensual sexual intercourse had lacerations to the posterior fornix; 3 of 5 females injured after rape were children

Table 2 (continued)

Authors	Country of sample	Classification of injury	Sample	Findings
Slaughter et al. ⁴²	USA	Lacerations Abrasions Ecchymosis Swelling Hymenal tears Microabrasions with use of a colposcope	Females 13–85 years of age (<i>n</i> = 131) following sexual assault; 113 White, 5 Black, 11 Hispanic, 2 Asian	114 of the 131 had positive injury findings with colposcope examination
Slaughter et al. ⁴	USA	TEARS	Females 11–85 years of age (<i>n</i> = 311) after sexual assault and healthy women (<i>n</i> = 75); of women who were injured (<i>n</i> = 213): 189 White, 6 Black, 17 Hispanic, 1 Asian	After sexual assault, 213 had genital trauma; 162 had 3.1 mean sites of injury; after consensual intercourse, 11% had injury all occurring at a single site
Sommers et al. ^{2,66}	USA	TEARS	Females after consensual sexual intercourse ages 21–68 years of age (<i>n</i> = 120); 50% White or other, 50% African American	55% had at least one ano-genital injury; while Black and White participants had significantly different genital injury prevalence (43% and 68% respectively), dark skin color rather than race was a strong predictor for decreased injury prevalence.
Sommers et al. ²⁹	USA	TEARS	Females after sexual assault 14–76+ years of age (<i>n</i> = 120); 50% White or other, 50% African American	Significant association between race/ethnicity (White and Black) and genital injury indicating that Whites were more than four times as likely as Blacks to have genital injury
Sturgiss et al. ⁶⁷	Australia	Abrasions Lacerations Redness Tenderness	Of 826 cases of sexual assault, 20 (19 females and 1 male) had penetration with foreign object; no race/ethnicity given	Foreign object assaults may be more violent with multiple assailants than other assaults; 75% of victims had genital injury and 91% of victims had non-genital injury
Sugar et al. ⁸	USA	Bruise/abrasion Laceration Radiologically defined fracture or intracranial injury Visible tissue injury Not counted as trauma: genital erythema, tenderness, or pain without visible tissue injury because were considered “subjective”	Female sexual assault victims 15–87 years of age (<i>n</i> = 819); 63.4% White, 20.5% African American, 4.9% Hispanic; 8.2 other	General body injury occurred in 52%; anal or genital injury occurred in 20%; attempted strangulation occurred in 99 out of 677. Females 15–19 years of age had more than twice the genital injuries as women 20–49; females over 49 had three times the genital injuries as women 20–49 years of age
Teixeira ⁶⁸	Brazil	Incomplete or complete rupture of hymen	Female sexual assault victims 4–51 years of age (<i>n</i> = 500); 78.2% White; 14.6% Tawny; 5.4% Black; .8% Yellow; 1% other	11.8% of the cases showed additional trauma when using colposcopy as compared to standard visual inspection
White and McLean ⁶⁹	Great Britain	Laceration Abrasion Bruise Burn Subjectively reported or potentially normal physiological features were excluded: reddening (erythema), swelling, tenderness	Sexual assault victims 12–17 years of age (<i>n</i> = 224); 90.2% White, 10.8% Non-White	32% of non-virgin group had genital injury; 53% in the virgin group had genital injury; 51% of both groups had non-genital injury
Zink et al. ⁴³	USA	TEARS	Females after consensual sexual intercourse ages 21–68 years of age (<i>n</i> = 120); 50% White or other, 50% African American	55% had at least one genital injury; direct visualization and colposcopy yielded similar genital injury findings; more tears were identified with toluidine-blue than with direct visual inspection or colposcopy

USA, United States of America; TEARS, tears, ecchymoses, abrasions, redness, swelling.

the medicolegal context of IPV and SV. Finally, we will suggest a typology of injury that could be developed and tested empirically, be used to classify genital and non-genital injury, and ultimately, improve the quality of forensic evidence.

2. Significance of physical injury in the context of sexual violence

In the context of IPV and SV, injury occurs across a continuum of violent actions ranging from a slap or push to chronic, severe battering or brutal, forced intercourse leading to genital and non-

genital lacerations, bleeding, or other tissue damage.^{10–13} Injury is significant from both a healthcare and criminal justice standpoint.

2.1. Healthcare significance of injury

The authors of the US National Protocol for Sexual Assault Medical Forensic Examinations place the highest priority on responding to acute injuries, whether genital or non-genital, to reduce complications from injury.¹⁰ They note that “redness, abrasions, bruises, swelling, lacerations, fractures, bites, burns, and other forms of physical trauma” need to be identified (protocol page 91) and treated.¹⁰ Management of injuries reduces exposure

Table 3

Relationship between victim's injury and criminal justice outcomes.

Citation	Sample, sample size, country of origin, and date of cases	Classification of injury	Source of injury data	Case outcome	Findings	Criminal justice stage
Campbell et al. ¹⁷	Adult sexual assault cases that were treated in the focal SANE program, <i>n</i> = 137; USA: 9/99 to 12/05	Bruising (physical and/or ano-genital) Abrasions (physical and/or ano-genital) Redness (physical and/or ano-genital) Tears (physical and/or ano-genital)	SANE records (complete forensic exam)	Four: (1) not referred by police for prosecution (2) referred to the prosecutor but not warranted for prosecution (3) warranted by the prosecution but later dropped or acquitted (4) guilty plea or conviction	Ano-genital or physical redness associated with greater odds of higher-level prosecutorial outcome. Abrasions, tears, and bruises not associated with case progression through criminal justice system due, at least partly, because of their low rates.	<i>Sentencing:</i> convicted/plead
Frazier and Haney ¹⁸	All cases of criminal sexual conduct-rape, <i>n</i> = 861; USA: 1991	Victim sustained injuries (e.g., cuts, bruises); assumed to be: Yes = 1, No = 0	Police records	Five: (1) whether a suspect was identified (2) where a suspect was questioned by police (3) whether the case was referred to the prosecuting attorney (4) where a suspect was charged (5) where a suspect was convicted and sentenced	Identified suspects more likely to be questioned when the victim was injured; referred suspects more likely to be charged if the victim was injured	<i>Investigation:</i> questioning: police's decision to question suspect <i>Charging:</i> prosecutor's decision to file charges
Jewkes et al. ²⁰	Attempted and completed rape cases reported to 70 randomly selected police stations, <i>n</i> = 2068; South Africa, 1/03–12/03 and which had been closed by the police at the time of data collection in 2006	Four-level injury variable: (1) No injury (2) Non-genital (or anal) injury only (incised wounds, lacerations, grazes, bruises, areas of tenderness that include whole body except ano-genital region) (3) Genital injury with a skin break only (incised wound, scratch, abrasion; was seen, or if there was scarring from indicator of greater severity of injury) (4) Non-genital and genital injuries with a skin break	Police dockets which included findings of the medical examination documented by medical examiner, and other reports from the Forensic Science Laboratory	Three: (1) being an arrest, (2) having a trial commence (among those arrested and asked to appear in court) (3) being found guilty (among those going to trial)	Injuries in adults did not appear to have any influence over arrests; in adults, genital injuries were more prevalent in cases where there was a conviction; no statistically significant association between presence of injury and where the suspect was arrested in adult cases (models not shown). Finding injuries was not associated with case progression to trial. However, having non-genital or genital injury, and having both, were strongly associated with conviction.	<i>Conviction</i>
Kingsnorth et al. ²¹	Adult sexual assault cases through court system in Sacramento County form prosecutorial intake through sentencing disposition, <i>n</i> = 467; USA, 1992–1994 cases, all cases achieved final disposition by July 1, 1996	Degree of injury to victim (for which a photographic record often exists) (0, no injury; 1, non-severe bruises; 2, severe bruises/lacerations)	Crime reports	Four: (1) decision to fully prosecute (2) trial versus plea (3) prison versus no prison (4) sentence in length of months	Degree of injury to victim increases the odds that the prosecutor will decide to proceed with full prosecution. Degree of injury to victim in non-stranger cases increases the odds that the prosecutor will decide to proceed with full prosecution (not significant in stranger cases). Degree of injury played a significant role in prosecutor's decision to fully prosecute non-stranger cases but not stranger cases. Degree of injury to victim not significant in decision to go to trial (versus plea), decision to go to trial in stranger or non-stranger cases, prison sentence versus non-prison sentence, or length	<i>Prosecution:</i> prosecutor's decision to fully prosecute

Table 3 (continued)

Citation	Sample, sample size, country of origin, and date of cases	Classification of injury	Source of injury data	Case outcome	Findings	Criminal justice stage
McGregor et al. ²²	Chart review of police-reported adult sexual assault cases handled by the Women's Sexual Assault Service for which a police report had been filed, <i>n</i> = 462; Canada, January 1993–December 1997	Clinical injury extent score: 0, no injury; 1, mild injury; 2, moderate injury; 3, severe injury Combines internal (e.g., genitalia) and external (bruising to head or neck)	Charts and medicolegal reports	Charge filing (yes/no) and conviction (yes/no)	of prison term; note that power is substantially lower than other analyses in paper because of statistical method chosen A gradient association was found for injury extent score and charges being filed. Injury extent score defined as severe was the only variable significantly associated with conviction	<i>Charging/laying of charges, conviction: prosecutor's decision to file charges</i>
McGregor et al. ²⁸	Charts and medicolegal reports of all case of sexual assault handled by the Women's Sexual Assault Service for which a police report had been filed, <i>n</i> = 95; Canada, 1992	Genital injury: none, injury, excluding tenderness, genital tenderness only, data missing Clinical injury score: 0, no injury; 1, mild injury; 2, moderate injury; 3, severe injury; in models coded 0 = no/mild injury and 1 = moderate/severe injury Combines internal (e.g., genitalia) and external (e.g., bruising to head or neck)	Charts and medicolegal reports	Laying of charges	Presence of genital injury, excluding tenderness was not significantly associated with laying of charges and dropped from model. The presence of documented moderate/severe injury significantly increased probability of laying of charges by prosecutor.	<i>Charging, laying of charges: prosecutor's decision to file charges</i>
Penttilä and Karhunen ²³	Medicolegal reports of alleged sexual offenses (mostly rape) cases received by the criminal police, <i>n</i> = 249; Finland, 1981–1987	Injuries classified according to region of the body (head, neck, trunk, upper extremities, lower extremities, thighs/buttocks, and sexual organs) and degree of severity. Major injuries comprised of several or numerous superficial bruises, scratches, abrasion, lacerations and/or tumescence of large areas in the mentioned regions of body. Other injuries were classified as minor.	Medicolegal reports	Sentence (imprisonment or fine)/length of imprisonment in four categories of number of years	The results show that in cases leading to imprisonment there were significantly more victims with severe injuries than in other categories (<i>n</i> = 12 severe injuries/imprisonment compared to <i>n</i> = 0 severe/fine) (<i>n</i> = 26 minor injuries/imprisonment compared to <i>n</i> = 0 minor/fine) (<i>n</i> = 2 no injuries/imprisonment compared to <i>n</i> = 1 no injuries/fine). Years in imprisonment >2.5 (<i>n</i> = 3 severe injuries, <i>n</i> = 3 minor injuries, <i>n</i> = 0 no injuries) The presence of severe injuries correlated more significantly with imprisonment and its length.	<i>Sentencing and length of sentence</i>
Rambow et al. ²⁴	Female sexual assault victims, <i>n</i> = 182; USA, 1983	Trauma defined as minor injury (e.g., abrasions, contusions, minor lacerations or vaginal or perineal injuries (e.g., small lacerations, contusions, and abrasions)	Medical records from examination	Prosecution (successful or unsuccessful)	Trauma is significantly associated with a successful prosecution. The injuries associated with conviction were multiple contusions and abrasions, human bites, lacerations of the perineum, lacerations/puncture wounds of the extremities, burns, and depressed skull fracture with severe head injury. The presence or absence of trauma appeared to be the major predictor of significance.	<i>Prosecution: successful prosecution</i>
Spears and Spohn ²⁵	All complaints of sexual offenses received by police, <i>n</i> = 1046; USA, 1989	Injury other than rape to the victim (Yes = 1, No = 0)	Police records	Prosecutor's decision to file charges or not	Victim injured was not statistically significant in predicting prosecutor's decision to charge	<i>Charging: prosecutor's decision to file charges</i>

(continued on next page)

Table 3 (continued)

Citation	Sample, sample size, country of origin, and date of cases	Classification of injury	Source of injury data	Case outcome	Findings	Criminal justice stage
Spohn et al. ²⁶	All sexual battery cases involving victims over the age of 12 that were cleared by arrest in 1997, <i>n</i> = 140; USA, 1997	Whether victim suffered collateral injuries such as bruises, cuts, burns, or internal injuries (Yes = 1, No = 0)	Police records	Prosecutor's decision to prosecute or not	Prosecutors more likely to prosecute if victim suffered some type of collateral injury	Prosecutor: prosecutor's decision to prosecute
Spohn and Holleran ²⁷	Sexual assaults that resulted in arrest, <i>n</i> = 526; USA, 1996–1998 in one location, 1997 in the other	Victim suffered collateral injuries, such as bruises, cuts, burns, or internal injuries (Yes = 1, No = 0)	Police case files	Prosecutor's decision to file charges or not	Presence of injury increased probability prosecutor filed charges involving PARTNER (not significant for stranger or acquaintance).	Charging: prosecutor's decision to file charges
Wiley et al. ³⁴	All female patients aged 15 or older with reported of sexual assault at an urban emergency department, <i>n</i> = 888; USA, 1/98–9/99	Trauma on the body or ano-genital area was categorized as either bruise/abrasion, laceration, or radiologically defined as intracranial injury or bone fracture Two dummy variables: Ano-genital trauma = 1/no = 0; general trauma = 1/no = 0	Emergency department records	A legal outcome indicated that the patient had a case that proceeded through the prosecutor's office. Five verdicts: (1) plea, (2) guilty, (3) acquitted, (4) dismissed, (5) declined	Ano-genital trauma was significantly associated with legal outcome whereas body trauma was not. No mention of relationship between trauma and any of the five verdicts	Charging: prosecutor's decision to file charges

to infection and lessens discomfort. Short-term follow-up to document wound healing is also a priority (protocol page 113) but no empirical work has been done to quantify complication rates upon follow-up.

Psychological trauma, Human Immunodeficiency Virus (HIV) seroconversion, and acquisition of sexually transmitted infections (STIs) are perhaps the most serious health-related consequences of rape. Psychological injury, while serious and complex, is outside the scope of this paper. HIV seroconversion has occurred following SV, but the prevalence is not well documented and the Centers for Disease Control and Prevention suggest that it is probably low.¹⁴ Varghese et al. found that in consensual sexual intercourse, the risk for HIV transmission from vaginal intercourse is 0.1–0.2% and for receptive rectal intercourse is 0.5–3%.¹⁵ Bleeding and genital injury associated with SV increase risk for HIV transmission theoretically, but little is known about prevalence in this situation.^{14,15} Following SV, the most frequently diagnosed STIs are trichomoniasis, bacterial vaginosis, gonorrhea, and chlamydia. While these infections are relatively common, their presence does not necessarily imply acquisition during rape.¹⁴ When children (*n* = 536) 0–13 years of age were evaluated for STIs following sexual victimization, 5.9% of girls were infected with *Trichomonas vaginalis*, 3.3% with *Neisseria gonorrhoeae*, and 3.1% with *Chlamydia trachomatis*. No girls (*n* = 485) or boys (*n* = 51) had serologic evidence of HIV, and no boys had an STI of any type.¹⁶ While genital injuries resulting from SV expose a female to the risk of bleeding, infection, pain, discomfort, structural damage, and reproductive dysfunction, serious physical health consequences of genital injury following rape appear to be uncommon. While approximately 10% of victimized girls are exposed to STIs,¹⁶ the association of STIs and genital injury is unknown.

2.2. Criminal justice significance

The criminal justice significance of injury is unclear. Both researchers and clinicians note that a significant number of persons who are raped are not injured (see Table 2 for multiple citations). While lack of clarity exists in the definition and categorization of injury, the findings from research reports collectively show that the

presence of injury influences decision making throughout the criminal justice process, especially at pivotal gate-keeping stages from victim reporting to police investigation to prosecutor discretion to judicial sentencing.^{17–27} In two studies from Canada, McGregor and colleagues reported that the presence of moderate or severe injury (AOR = 3.33; 95%CI = 1.06–10.42, *p* < 0.0001,) was significantly associated with the filing of charges following rape. In addition, the investigators found that moderate injury alone (e.g. genital lacerations, abrasions) was significantly related to the filing of charges (AOR = 4.00; 95%CI = 1.63–9.84, *p* < 0.001).^{22,28} Spohn and her colleagues investigated the prosecutor's decision to file charges or prosecute in three US locations.^{26,27} In the first study of 526 victims of sexual assault that resulted in arrest, they found that the presence of collateral injury such as bruises, cuts, burns, or internal injuries increased the probability that the prosecutor filed charges involving partners but not strangers or acquaintances.²⁷ In the second study of 140 cases of sexual battery, they found that prosecutors were more likely to prosecute if victims suffered some type of collateral injury than if they were uninjured.²⁶ In both of these studies, injury was treated as a binary variable: yes (injury present) or no (injury not present).

In other US studies, Rambow et al. found evidence that the presence of injury was significantly related to the successful prosecution of rape cases ($\chi^2 = 7.85$, *df* = 1, *p* < 0.01),²⁴ and Gray-Eurom et al. found that the presence of injury (OR = 1.92, 95% CI = 1.08–3.43, *p* < 0.05) was significantly associated with a guilty conviction in rape cases.¹⁹ Using data from Finland, Penttilä and Karhunen reported that the association of severe injuries and the defendant being sentenced to prison approached significance.²³ In a series of sexual assault cases in the US, Campbell and others found that ano-genital or physical redness was associated with a greater odds of higher-level prosecutorial outcome.¹⁷ In the same study, abrasions, tears, and bruises were not associated with case progression through criminal justice system due, in part, because of their low prevalence.

In all of these investigations, the classification systems included both genital and non-genital injury, and the investigations were completed in a variety of countries and locales with different statutes and criminal justice systems, lessening their generalizability.

Even so, their collective results consistently show that victim injury in sexual assault cases has a significant role throughout decisions made in criminal justice systems.

3. How does injury prevalence relate?

The presence or absence of injury after SV is related to the event itself and factors such as the age of the victim, the use of birth control, and many other individual factors.^{2,29–31} Injury alone does not predict rape. Data from qualitative interviews from sexual assault nurse examiners suggest they observe an over-emphasis on visualization of injury: "...someone could be terrorized, there for three days, but if they don't have a bruise...it's [going to be perceived as] a minimal offense."³² A growing body of literature demonstrates that many victims do not show signs of physical injury following sexual assault.^{29,31,33,34} Conversely, no expert in the published literature advocates that we entirely ignore injury as evidence and Ledray comments that "injuries are probably the best proof of force."³⁵ Thus, while injury or lack of injury is only one aspect in a constellation of evidence used in the criminal justice system, most experts view injury as relevant.

The prevalence of non-genital injury varies by investigator and population. Jones et al. reported a non-genital injury prevalence of 43.5% in pre-menopausal ($n = 1610$) and 61.1% in menopausal women ($n = 72$) following sexual assault.³¹ These same investigators found a non-genital injury prevalence of 33% in adolescents after sexual assault.³⁶ Maguire et al. found a non-genital ("body") injury prevalence of 61.1% in females 13–73 years. In their series of 164 women, those ($n = 137$) examined within 72 h had a significantly higher non-genital injury prevalence than those examined after 72 h (66% versus 33%; OR = 4.00; 95%CI = 1.59–10.04, $p < 0.01$).⁵ In general, the prevalence of non-genital injury ranges widely from 30% to 70% in data reported as series of sexual assault case.^{5,8,36,37}

3.1. Severity of injury

Experts agree that most genital injuries occurring with SV are minor.^{1,2,24,28,38–40} The prevalence of genital injury resulting from sexual assault ranges from 5% on direct visualization⁴¹ to 87% with colposcopic technique.⁴² The examination technique makes a difference in genital injury prevalence. In a consensual sexual intercourse population, Zink et al. found that more tears and abrasions of the external genitalia were identified with toluidine-blue than with direct visual inspection or colposcopy ($p < 0.05$).⁴³ Authors of several large series of cases from sexual assault programs report that genital injury prevalence ranges from 50% to 85%.^{31,33,44,45}

Hilden et al. found in a sample of 249 sexually assaulted women that tears ranged from 2 to 25 mm in size and did not require surgical repair; most occurred at a single site.³⁸ Bowyer and Dalton found that most genital injuries after sexual assault were minor and included tears, bruises, scratches, and grazes.⁴⁰ Geist noted that less than 2% of women have clinically significant genital injuries following rape.³⁹ McGregor et al. considered all genital injuries as "mild" or "moderate." Their "severe" category of injury included concussion, organ contusion, fracture, and attempted strangulation, but not genital injury.²⁸

The prevalence and definition of serious genital injury remains somewhat elusive. Dunlap et al. developed an injury severity score by using experts who ranked injury from least severe to most severe.⁴⁶ Self-reported tenderness was ranked as the least severe injury descriptor, followed by pain, soft tissue trauma (contusions and bruises), lacerations, fractures, and finally, internal injuries were rated as the most severe injury descriptor. In a retrospective review of records ($n = 751$), the same investigators found an injury prevalence of 55.5%. The severity of injury was positively associated

with the number of medical procedures such as physical examination and STI testing that the women received during treatment ($r = 0.327$, $p < 0.01$).⁴⁶ The combination of self-reported symptoms and tissue injury in their classification system, however, makes for an unwieldy injury scoring system that is difficult to administer prospectively.

In a retrospective analysis of 1076 cases of sexual assault, Riggs et al. found that 20% of the victims required additional medical procedures such as X-rays, computed tomography, urinalysis, hematocrit measurement, or suturing, but the authors discussed neither the nature of the injury (genital versus non-genital), nor the number of each procedure that occurred.³⁷ Ramin et al. studied 129 post-menopausal women following sexual assault and compared them to 129 pre-menopausal females. Twenty-four post-menopausal victims had genital lacerations, six of which needed suturing, whereas six pre-menopausal victims had lacerations, none of which needed suturing.⁴⁷ These findings indicated that older women are likely to have more severe genital injuries than younger, but the authors were silent on a definition for "serious" injury. No definitions of serious genital injury were found in published research.

In summary, the literature reflects significant variability of injury prevalence and type by population, location, and detection technique. Of particular note are the differences in injury prevalence based on examination technique such as visual inspection, use of the colposcopic technique, and use of contract media such as toluidine-blue dye. Prospective studies comparing injury prevalence in comparable populations with comparable visualization techniques will illuminate our understanding of the forensic significance of injury in the sexual assault population. While a number of investigative teams have grappled with the issue of injury severity classifications and their predictive ability, no standard measure directly tied to injury outcome is presently available. Clearly further work is needed in the areas of injury classification and injury severity.

3.2. Ethics of forensic data collection

Several authors have debated the usefulness and even the ethics of collecting forensic injury data on sexual assault victims. This debate is acknowledged by Bowyer and Dalton, who note, "The issue of genital injury and its association with rape is contentious, but genital injury is still thought to carry more weight in the courts to obtain conviction."⁴⁰ White and Dumont raised specific and serious issues about the use of techniques such as colposcopy with digital imaging capture to visualize and document genital injury following a sexual assault.³ They posit that the use of technology to illustrate the "truth" of the women's narrative of the sexual assault perpetuates the rape myth that women are untrustworthy. In their discussion to support their thesis, they note: "The demand for visual proof collected through photographic tools underpins the positive approach in the pursuit of legal truth. The generation of this evidence is based on producing discrete and decontextualized empirical facts through what are perceived to be objective technologies." In addition, they suggest that examination for injuries in some way precludes concern about the emotional, psychological, and social harm of sexual assault.

As supporting evidence for these opinions, they report on a qualitative analysis of data from focus groups and open-ended interviews of five sexual assault examiners. The examiners noted that, while injuries can be useful because they correspond to the women's narrative about the event, documenting internal and external injuries led to fragmenting and objectifying the bodies of the victims. These findings are in sharp contrast to data from interviews collected from victims themselves reported by the same

investigative team.³² In semi-structured, face-to-face interviews, victims ($n = 19$) suggested that the medical forensic examination: (1) provided a vehicle to get evidence or proof of the assault; (2) forced the assailant to take responsibility; (3) helped identify the assailant; (4) proved the assailant's guilt; (5) prevented the assailant from re-assaulting other women; and (6) increased the victims' sense of safety (p. 776).

The role of photo-documentation of injury varies by sexual assault program and jurisdictional policy. White and Dumont make a convincing case that the demand for "visual proof" has the potential to decontextualize forensic evidence.³ In contrast, a recent study of image quality illustrates the profound difficulty of maintaining standardization of forensic photo-documentation and interpretation.⁴⁸ Digital images of female genital injuries were collected as part of a research protocol and rated for "quality." The study, however, was confounded by multiple methodological errors including lack of data on the validity of the raters' expertise, lack of control over image delivery systems (computer monitors and software, room lighting), and a lack of relevance of the outcome measures (naturalness and usefulness). The quality of digital images is a fertile area for exploration as photo-documentation becomes routine,¹⁰ but interpretation needs to be empirically tested with a rigorous methodological approach. As noted in the US National Protocol for Sexual Assault Medical Forensic Examinations, "Involved prosecutors, law enforcement officials, examiners, and advocates should further discuss the extent of photography they view as critical, examine any related case law, consider their concerns on this issue and how to be sensitive to victims, and, ultimately, determine what strategy is right for their community (p. 85)."¹⁰

White and Dumont raised significant questions about the importance of visualizing and documenting physical injury during the sexual assault forensic examination.³ The victims themselves did not corroborate the argument that the examination decontextualized their own experience. Victims viewed the examination as very difficult, and two viewed it as a revictimization. But most commented that the examination was a mechanism to regain control, be empowered, and obtain "objective proof" of what happened to them.³² Hence, in the voices of the victims themselves, more were empowered by the examination than expressed concern over a positivist approach that minimized their emotional, psychological, and social distress. The victims seem to be telling us to continue to refine and improve the forensic examination, not to eliminate it.

3.3. Summary of overall significance

What is the overall significance, therefore, from both a healthcare and criminal justice perspective, of all types of injury resulting from IPV and SV? Evidence of injury is a part of a constellation of evidentiary factors of alleged rape (e.g., DNA results, presence of a weapon) used by the complainant, law enforcement, attorneys, jury and judge to make decisions. The examiner's role is to detect injuries and describe them accurately and precisely. The interpretation of the injuries is left to the law enforcement, the jury, and the judge. Further research into healthcare and criminal justice outcomes following IPV and SV has the potential to improve the quality of forensic evidence proffered and decisions made throughout the criminal justice process.² While a small number of authors debate the utility of injury assessment and documentation in sexual assault,³ most experts and authors of the US National Protocol for Sexual Assault Medical Forensic Examinations observe that injury findings are a critical part of the forensic examination.^{4,10,24}

Scientific work in the area of injury identification and documentation remains critical. Forensic evidence of injury obtained

through improved forensic techniques could be used to corroborate other physical evidence and the victim's testimony, influence more objective decision making, and ultimately contribute to enhancing the quality of justice for victims of IPV and SV. Most experts and the victims themselves recommend a careful forensic examination that includes identification of injury. Whether or not injury detection will lead to improved healthcare and criminal justice outcomes will remain an unanswered question until scientists complete further research.

4. Current status of injury classification systems

Investigators have developed a number of ways to classify injury resulting from IPV and SV. The most commonly used classification in the US is the TEARS system, developed by Slaughter et al. and based on injury type.⁴ *Tears* are defined as any breaks in tissue integrity including fissures, cracks, lacerations, cuts, gashes or rips. *Ecchymoses* are defined as skin or mucous membrane discolorations, also known as "bruising" due to the damage of small blood vessels beneath the skin or mucous membrane surface. *Abrasions* are defined as skin excoriations caused by the removal of the epidermal layer and with a defined edge. *Redness* is erythematous skin that is abnormally inflamed due to irritation or injury without a defined edge or border. *Swelling* is edematous or transient engorgement of tissues.⁴⁹ However, in the past 30 years, scientist and clinicians from more than a dozen countries as diverse as Nigeria, Brazil, Australia, and China^{6,29,30,43,50–69} have used a variety of typologies other than TEARS to classify injuries related to consensual sexual intercourse as well as those associated with IPV and SV. Clearly there is a need to classify genital and non-genital injuries related to violence, but we could find no consensus in the literature with respect to the best approach that will serve clinicians and scientists alike.

4.1. Classification systems for genital injury

In addition to the aforementioned TEARS classification,⁴ published classification systems can be grouped in four ways: typologies that organize injuries by (1) severity; (2) anatomical location; (3) injury type; and (4) symptomatology. Investigators often mix these typologies. For example, Palmer et al. classified injuries as both genital and non-genital; as minor, moderate, and severe; and as injury type such as bruises and lacerations.⁶

From a criminal justice standpoint, probably the most useful typology is injury severity. The more severe the injury the victim sustains, the more likely that charges will be filed^{28,70} and the prosecution will be successful.²⁴ However, when investigators such as McGregor et al.,²⁸ Adams et al.,⁷ and Palmer et al.⁶ used an injury severity scoring system, they concurrently used other typologies to explain the nature and patterns of genital and non-genital injury or they mixed symptoms with injuries.⁴⁶ Hence, a classification system that includes data other than injury severity seems to be indicated. Other investigators have approached severity classification differently. Jones and Worthington⁵⁸ applied an intriguing model of genital injury severity in children⁷¹ to categorize and grade genital injury in 44 girls who required surgical repair following genital injury. In their work, the injury severity score ranges from Grade I (isolated genital laceration below the hymen) to Grade V (genital laceration including the vagina plus a complete tear of the anorectum). Components of the scoring system include severity (Grade), location (hymen, vagina, anorectum), and type (laceration).^{58,71}

Many investigators ignore severity entirely and use a combined measure of anatomical location and injury type to describe genital injury. For instance, Adams et al.⁷ and Slaughter et al.⁴ use

definitive anatomic landmarks such as posterior fourchette, labia minora, and labia majora to indicate the site of genital injury. While their terminology is slightly different, both essentially use the TEARS system to describe injury type. Neither provides a specific definition for each injury type; the definition of the terms in TEARS seems to first appear in the work published by Sommers et al.^{29,49} Several authors include physical symptoms of injury, such as bleeding,^{33,72,73} tenderness,^{46,55} and pain^{46,51} in their typologies, but such inclusion is unusual.

There are many opportunities in the clinical arena for error to occur with genital injury classification. Clinicians may have differing definitions of anatomical regions or be unfamiliar with normal cervical changes due to hormonal patterns. They may not discriminate between pain and tenderness. Practitioners from different disciplines, such as obstetrics and trauma, may view injury severity quite differently. These differences can best be handled by training, quality control, and specific descriptions of all components of the classification system.

4.2. Classification systems for non-genital injury

Organization of non-genital injury classifications also varies greatly. McGregor et al.²⁸ included genital and non-genital injury in their mild and moderate categories, but the severe injury category contained only non-genital injuries such as head injury, evidence of strangulation, and bone fractures. Everett and Jimmerson⁷⁴ incorporated choke-related (strangulation) injury as well as stab and gunshot wounds in their non-genital injury classification. Disagreement occurs even among investigators about non-genital anatomical locations. Bowyer and Dalton⁴⁰ used an extensive list of 11 anatomical sites, Penttilä and Karhunen used six,²³ and Goodyear-Smith⁵⁵ collapsed the sites into five: face, head, trunk, arms, and legs.

4.3. Summary of classification systems

Despite more than 30 years of investigations about genital and non-genital injury resulting from IPV and SV, no standard typology exists. Regardless of the typology chosen, most authors do not define the components of their injury classification system and even disagree on basic anatomical categories that are useful clinically and scientifically. Clearly several steps are needed to standardize an injury classification if clinicians and scientists are to best

serve victims of IPV and SV. First, a logical system for injury severity needs to be developed. Second, components of the system need explicit definitions. Finally, typologies need to be tested empirically to estimate their predictive value and reproducibility across populations and settings.

Many investigators working in the field of injury documentation from IPV and SV have combined injury severity, injury location, and injury type into their typologies to create a three dimensional description of injury pattern. This model is similar to the graded model developed by Jones and Worthington,⁵⁸ which appears to be a useful starting point. Once an injury severity typology is developed for both genital and non-genital injury with specific descriptors, it needs to be tested empirically in both the consensual sexual intercourse and rape populations to determine its usefulness to predict both healthcare and criminal justice endpoints.

5. Proposed injury typology for IPV and SV

We propose the Penn Injury Classification System (PICS; Table 4) as a starting point for discussion and empirical testing. This system has several advantages as compared to other typologies. First, we use a graded approach, which will allow investigators to calculate a numeric, averaged severity score across populations. Such an injury score may help investigators to quantify healthcare and criminal justice outcomes. Second, we identify discrete anatomic categories so that investigators and scientists can compare severity and location of injury. We have defined three ano-genital locations (genitalia [labia majora, labia minora, periurethral area, perineum, posterior fourchette, and fossa navicularis], internal genitalia [hymen, vagina, cervix], and anus [rectum]) and four non-genital locations (head–face–neck, trunk–buttocks–back, upper extremities, lower extremities). Finally, we define specific, measurable parameters delineating injury severity that practitioners use to classify injury.

Several psychometric steps are needed for the PICS to become clinically useful. First, the instrument will undergo content validity testing with an expert panel. Following revisions based on content validity determination, the instrument will be used in a number of sexual assault programs by practitioners to determine if three grades can discriminate injury severity and predict differences in a variety of outcomes such as STIs, numbers of procedures, and judicial outcomes. Finally, the feasibility and ease of use across large populations will be determined in national samples. While the

Table 4

Penn injury classification system (PICS): a proposed genital injury classification for genital and non-genital injury resulting from IPV and SV.

Classification	Genital injury	Non-genital injury
Anatomic location	External genitalia Internal genitalia Anus and rectum	Head–face–neck Trunk–buttocks–back Upper extremities Lower extremities
Grade I	<ul style="list-style-type: none"> Redness, swelling Bruising and/or abrasions < 5 mm in size Superficial skin injury of any type (see Table 1) < 5 mm in size 	<ul style="list-style-type: none"> Redness, swelling Bruising and/or abrasions < 5 mm in size Superficial skin injury of any type (see Table 1) < 5 mm in size
Grade II	<ul style="list-style-type: none"> Lacerations < 25 mm^a in size that do not require suturing Bruising and/or abrasions ≥ 5 mm and ≤ 25 mm^a Superficial skin injury of any type (see Table 1) ≥ 5 mm or more in size 	<ul style="list-style-type: none"> Lacerations < 25 mm^a in size that do not require suturing Bruising and/or abrasions ≥ 5 mm and covering ≤ 25% of body surface area Superficial skin injury of any type (see Table 1) ≥ 5 mm or more in size
Grade III	<ul style="list-style-type: none"> Lacerations that require suturing or are > 25 mm in size^a Bruising and/or abrasions > 20 mm 	<ul style="list-style-type: none"> Lacerations that require suturing or are > 25 mm in size^a Bruising and/or abrasions covering >25% of body surface area Bone fractures Evidence of attempted strangulation or choking Internal organ contusion (bruising) or concussion (organ damage from violent blow)

^a From Ref. 38.

injury categories and grades will likely change with empirical testing, they provide a starting point for initial testing for construct validity and reliability.

6. Conclusions

While nuanced and controversial issues surround the role of genital and non-genital injury detection in the sexual assault forensic examination, enough evidence exists to support the contributions of injury documentation to pursue a scientific approach to injury classification. Herein we propose a typology that is measurable and applicable to the healthcare setting and criminal justice system. We have used a matrix approach that includes a severity score, anatomic location, and injury type. We hope that the community of scientists and clinicians concerned about IPV and SV will coalesce around an empirically tested classification system to be applied across multiple samples and to produce comparable data. Our ultimate goal is to improve the care of sexual assault victims and improve the quality of forensic evidence proffered and decisions made throughout the criminal justice process. Ultimately, this evidence might be used, along with corroborating evidence, throughout the criminal justice system to strengthen the case that a sexual assault was committed.

Conflicts of interest

None.

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